

## A SURVEY OF NESTING HAWKS, EAGLES, FALCONS AND OWLS IN CURLEW VALLEY, UTAH

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**ABSTRACT.**—During the summer of 1969 a survey involving 45 nesting nocturnal and diurnal birds of prey was made. Prey items, nest site selections, and productivity for great horned, long-eared, burrowing and short-eared owls, golden eagle, prairie falcon, kestrel, harrier and ferruginous, red-tailed and Swainson's hawks were determined. The turkey vulture, accipiter hawks, barn and screech owls were also recorded.

The total raptor impact on the environment was determined to be slight, whereas the limits placed on the nesting species are considered substantial. It was noted that immature eagles were in the valley and, because they did not require a nest site, were able to utilize areas away from suitable nest sites. Ferruginous hawks had a clumped distribution because the nest sites (junipers) were aggregated on the valley floor. Red-tailed hawks and kestrels required nest sites not typically found in undisturbed desert communities and were found more commonly in agricultural lands. The golden eagle was the only species studied that did not produce a replacement population, i.e., a minimum of two young per pair, although observations outside the valley proved this to be a local phenomenon.

Curlew Valley is a sagebrush basin located on the Utah-Idaho border. It is bounded on the east and west by mountain ranges rising 9,900 ft above sea level. To the north rolling hills close the valley off from the Arbon and Rockford valleys. To the south lie the salt flats of the Great Salt Lake and the lake itself. Elevation of the valley floor begins at 4,200 ft above sea level near the salt flats and steadily rises to the north. The northern edge of the valley floor was determined to be 4,950 ft above sea level.

The climate is arid. The northern region receives 12 to 14 inches of precipitation while the southern part receives less than 8 inches annually. It comes mostly between fall and spring, with only localized storms to break the summer drought. Mean July temperatures are about 20 C, with 38 C commonly reached during July and August. Twenty-four-hour fluctuations of 20 C are also common.

The receding waters of glacial Lake Bonneville and its remnant, the Great Salt Lake, have had a profound effect on the vegetation of Curlew Valley. The salt flats to the south are too harsh for any plant. Pickleweed (*Allenrolfia occidentalis*) is first to pioneer. Moving north and away from the lake, greasewood (*Sarcobatus vermiculatus*), shadscale (*Atriplex confertifolia*), and big sagebrush (*Artemisia tridentata*) appear in distinct communities. Utah juniper (*Juniperus osteosperma*) covers the valley slopes and occurs in scattered stands throughout the valley.

The native fauna includes 20-30 species of rodents and lagomorphs. Birds are represented by 20-30 species of passerines and 13 species of raptors. There are 10-15 species of reptiles represented (Desert Biome Research Design, May 1969).

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Land use in the south is limited to grazing cattle and some sheep. Some reseeded with crested wheat grass (*Agropyron cristatus*) has intensified the grazing effort. These reseeds amount to 10% of the valley and are in various stages of reverting to sage.

Near U.S. Highway 30, which nearly bisects the valley into a northern and southern half, dry-land wheat farming becomes a common land use. Fourteen per cent of the valley floor, predominantly in the northern half, is under farming use.

#### PURPOSE AND METHODS

The purpose of this study was to find the relative abundance of nesting raptors, determine their nesting success, and sample their food habits. Studies of individual species have been made in the West (see Murphy et al.) 1969; McGahan, 1968) but little is known about the total role of predacious birds in a desert community and the limiting factors imposed on raptors by the community. The study was limited to the valley floor, that part of the valley below 5,000 ft, thereby eliminating the valley slopes which were densely covered by juniper. The time required to search these slopes could not be justified by the slight returns of nests found. Five hundred and forty square miles were then outlined as the study area on the floor of Curlew Valley. The study was conducted from March through July 1969.

Search methods consisted of driving the meager road system, watching for raptor movements, and visiting rock outcroppings and isolated trees. Observations were begun well before deciduous trees leafed out in mid-April. Two flights were made over the study area in a Piper Super Cub to locate nests. It proved very effective late in the season over juniper stands where *Buteo* activity was suspected. Observation was aided by a Bausch and Lomb 20-30 x 60 mm spotting scope and 8 x 30 mm binoculars. Other students working on separate projects in the same area contributed greatly with their findings. Forty-five nests of raptors were found; they represented 11 of the 13 species present.

#### GREAT HORNED OWL

##### *Bubo virginianus*

The first bird of prey to bring off young in the spring was the Great Horned Owl. The average hatching date for the three nests found was 1 April, with a four-day spread. An average of 2.3 eggs hatched per nest (Range 3-2). One nest failed, reducing the fledging success to 1.7 (3-2) for the three nests. Average fledging date was 8 May.

Two of the owl nests were between agricultural lands and sagebrush hills; the nests were within 300 yards of one another. A bend in the canyon separated the sites. Food remains reflected a similarity in prey taken. In 7 entire pellets from one nest, there were 16 prey items, including 11 *Microtus*, 3 *Peromyscus*, and 2 unidentified

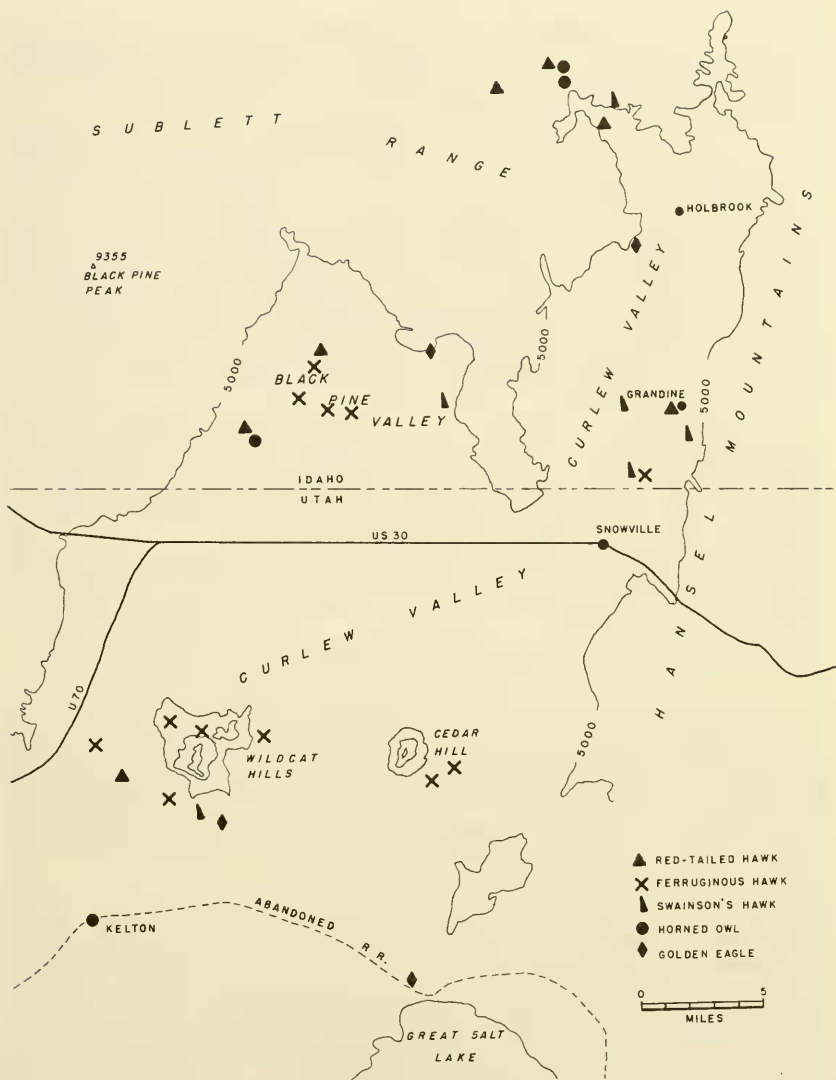


Fig. 1. Nest site grouping for five species of raptors in Curlew Valley, Utah.

rodents. An analysis of broken pellets from the same nest showed the same predominance of *Microtus*. Of 36 individuals, 14 were *Microtus*, 6 *Peromyscus*, 4 *Thomomys*, 2 *Lagurus*, and 1 *Perognathus*; there were also 9 unidentified rodents.

In 5 pellets from the neighboring nest 4 *Microtus*, 3 *Lagurus*, one each of *Peromyscus* and *Thomomys*, and an unidentified rodent were found. A gray partridge (*Perdix perdix*) was also found.

Both pairs of nesting owls seemed to be hunting the sage-grass-land areas as well as the dry farmland. *Peromyscus* and *Lagurus* are resident in sagebrush, while *Microtus* and *Thomomys* frequented the disturbed (i.e., farm or pasture) areas. As an indication of a night's success, one nest was twice found to contain two fresh cottontail rabbits (*Sylvilagus sp.*). An early morning visit to the other nest produced 12 rodents: 8 *Microtus*, 3 *Onychomys*, and 1 *Lagurus*.

The third horned owl pair nested in an abandoned farmyard in Blackpine Valley. The country was considerably more open, with heavy cattle grazing on much of the surrounding land. Twenty-five prey items were found in 12 pellets: 13 *Microtus*, 6 *Peromyscus*, 3 entirely of rabbit, 1 *Lagurus*, and 2 unidentified mammals. Seven of the nonrabbit pellets contained rabbit fur. In a single visit, 1 cottontail and 2 young, partially eaten jack rabbits (*Lepus californicus*) were in the nest.

The scarcity of *Lagurus*, which is found in native vegetation, and the predominance of *Microtus* and rabbit are indications of the disturbance to the range. The Blackpine nesting pair's prey items differed markedly from the other two nests, but both were indicative of the prey items available in their respective areas.

Great horned owls were resident throughout the winter in Curlew Valley. In November and every month thereafter, hooting was heard at two nest sites.

#### LONG-EARED OWL

##### *Asio otus*

Long-eared owls occur in small but undetermined numbers. One nest was found and another reported. The nest examined was in a windbreak of Russian olive between a pasture with sagebrush and a field of wheat. A topless magpie nest was used. Four young, varying greatly in size, and an infertile egg were found. The average date for fledging was 12 May.

Fourteen prey items were found in nine pellets. They were: 5 *Microtus*, 2 *Peromyscus*, 2 *Perognathus*, and 5 unidentified small mammals. Insects (Coleoptera) were present in one pellet.

The owls seem wholly nocturnal and were never observed away from the nest trees. Magpies nested within 50 yards.

#### BURROWING OWL

##### *Speotyto cunicularia*

Burrowing owls were a very common nesting raptor; in all cases badger dens were used. Early in the nesting cycle one adult of each pair habitually perched on the mound at the burrow's mouth. Upon approach, the perched adult would crouch in the hole or behind the mound with only its eyes and upper portion of its head showing. As the intrusion became certain it would fly 10 or 15 yards and perch on the ground. Sometimes a second adult would then flush from the

interior of the burrow. After flushing, an adult would occasionally pass overhead, calling in protest.

In a two-hour aircraft flight in search of coyote dens, 16 burrowing owls were seen perched at the mouth of badger burrows. This is another indication of the abundance of this raptor.

Production could not be determined prior to the emergence of the young. The three nests investigated in depth produced an average of five young (7-3). The young emerged during the first week in June. They still scurried underground during July for safety rather than flushing. One of the three burrows was accidentally destroyed by chaining the land to clear sagebrush.

The burrowing owls brought dry cow dung into the dens; small flakes of dung covered the mound of the burrows as well as the floor of the entrance (see also Bent, 1938:385). With the increase in traffic when the young emerged, the dung was scattered and mixed with the surrounding dirt.

Burrowing owls are largely diurnal. They could be seen during cooler days perched on fence posts. Few pellets were found around the burrows before the young began emerging. Prey items, however, were found. They were *Peromyscus*, *Microtus*, a toad (*Bufo* sp.), Coleoptera, a skink lizard (*Eumeces multivirgatus*), a scorpion (Scorpionida), an immature horned lark (*Eremophila alpestris*), and unidentifiable insects.

When the young began coming above ground to perch around the mound, pellets became numerous. Eighteen complete pellets were examined; three were entirely of insect remains, 8 *Peromyscus*, 6 *Microtus*, 2 *Lagurus*, 1 unidentified rodent, and an insectivorous bird (probably horned lark) were found. All but two pellets had some insect remains. Of all the raptors studied, these owls made the greatest use of insects.

#### BARN OWL

##### *Tyto alba*

In late June a female road-killed barn owl was found on the western edge of Snowville, Utah. It had a brood patch that suggested it was nesting in the area.

In late July three immature barn owls were flushed from along the high dirt banks of Deep Creek, 4 miles from where the female was recovered. The most likely nest sites were cavities in this creek bank.

Whether the road-killed barn owl was part of this family group or not, there apparently were more than two adults in the area.

#### SCREECH OWL

##### *Otus asio*

The screech owl was an uncommon nester. One nest containing four young was found during May. However, half of the young were removed thereby invalidating production data.



The nest was in a hollow of a juniper tree. It was located off the valley floor on the slopes west of Kelton.

#### SHORT-EARED OWL

##### *Asio flammeus*

Short-eared owls were seen commonly during cooler days perched on fence posts. About dusk, as the harrier (*Circus cyaneus*) activity dropped off, short-ears began flying low over sagebrush and agricultural fields. Like harriers, they hunted from low perches or by coursing over vegetation. They are similar in size and ability to subdue prey; it seemed that harriers and short-eared owls were exerting constant diel pressure upon those species vulnerable to their methods of hunting (see also Sparks and Soper, 1970:137).

Nests were in sagebrush as well as in the grass pastures. Young were fledged at two different times during the summer. The main fledging was throughout May. During the first week of July, however, three family groups were found made up of young barely mature enough to fly. Raptors have a relatively long period of dependence after fledging. The late nestings mentioned are not interpreted as an indication of owls raising two clutches in a single season. It does indicate, however, that the owls are capable of renesting.

Thirteen prey items were identified at one nest from pellets. Eight were *Peromyscus*, 3 *Microtus*, 1 *Lagurus*, and 1 unidentified rodent.

Perhaps a dozen short-ears were found dead on the roads of Curlew Valley. Only two burrowing owls were found dead and one Swainson's hawk (*Buteo swainsoni*). The kills were not in connection with carrion and were predominantly immature short-ears (deaths were probably due to chasing quarry in front of cars).

It is not known if short-ears winter in Curlew Valley; they are found in northern Utah all winter. On 12 February ten birds were seen in Curlew during the day—all in a group, flying, sitting, and chasing one another.

#### GOLDEN EAGLE

##### *Aquila chrysaetos*

Four golden eagle nests were found in the valley; three of the four failed. One of these nests was abandoned when rocks from an overhang fell onto it. The rocks were larger than the eggs and prevented incubation. The adults, however, remained in the area. The second nest contained three eggs (typical clutches have two). It is not known why this pair failed. A single adult bird was still seen near the nest during August.

The third nest to fail was not found until after young should have fledged (30 June). Two adults frequented a group of cliffs. No young were ever seen with them. A nest was found with molted eagle feathers in and around it. It was well lined with straw, and sprigs of green juniper were present. The cup was well defined.

The nest had no food remains and the amount of excrement suggested there had never been young in the nest. The nest was easily accessible to any mammalian predator, and predation may have caused its failure. Another possibility is that the pair were too young to breed but had established a pair bond (as suggested by Brown and Amadon, 1968:668).

The one successful nest fledged two young. Like the other three it was a cliff nest. Young hatched during the last week of April. Fledging was on 7 and 10 June, the smaller eaglet leaving first. Thirty-one prey items were removed from the eyrie; they consisted of an adult short-eared owl and 30 rabbits. At least 80% of the rabbits were adult jack rabbits; the other 20% were either young jack rabbits or cottontail rabbits. An eagle nest provided the only obvious example of carrion feeding for this study. A nest which failed had the foreleg of a deer in it.

Four nonbreeding immatures were regularly seen. These eagles were paired into two groups. In both groups the two birds perched and were generally together. All bore the basal white tail of birds less than four years and therefore were too young to breed (Brown and Amadon, 1968:668). Two additional immatures were recorded separately, but were not confined to any area.

Golden eagles were not found in Curlew Valley during the late winter. In November, a subadult (i.e., less than four years old) was flushed from a rabbit. The next sighting, again of an immature, was in March.

#### PRAIRIE FALCON

##### *Falco mexicanus*

Two pairs of prairie falcons nested in Curlew Valley; both were successful although the nests were less than 4 miles apart. Each pair had 5 fertile eggs. One of the 10 eggs failed to hatch, giving an average hatching of 4.5. The average fledging success was also 4.5. Mean hatching date was 8 May; fledging dates averaged 13 June.

Three pellets were found at the northernmost nest in the week hatching occurred. One pellet contained rabbit, one an antelope ground squirrel (*Citellus leucurus*), and the third a horned lark. On the day the southern nest hatched, five pellets were gathered. Three of these were the remains of mammals and two, the remains of an avocet (*Recuricirostra americana*). These pellets were from the adult birds, as the young are not fed roughage until they are older than these birds were at the time the above collections were made. Both nests reflect an adult diet with mammals forming 60%. Twelve days after hatching, one nest contained six pellets and the remains of five avocets. Five of the pellets contained fur, but all had feathers in them. After another six days, the remains of four avocets and two passerines were found in the same nest. The only mammalian evidence was a single cottontail rabbit leg. Apparently the adults were feeding on the abundant mammal population until the young

hatched. Then, presumably for the young's dietary need or because of the supply of immature birds available, the prey selection switched to birds. Of note also was the heavy utilization of avocets by one pair. In 18 days 11 avocets were brought to the nest. The nearest avocet habitat was over 4 miles away. Entire birds were sometimes brought in. A single horned lizard (*Phrynosoma* sp.) was brought to the nest but was not consumed.

Prairie falcons wintered in the northern part of Curlew Valley. Immatures were found until December. At that time adults established territories and would not tolerate the younger birds. Adults were seen chasing immatures as early as October.

### KESTREL

#### *Falco sparverius*

Male kestrels were found in Curlew Valley throughout the winter. In 5 surveys made during the winter, 18 kestrels were sexed (19 were seen), 17 were males (see Willoughby and Cade, 1964, for similar findings of sex ratio imbalance). The single female is discussed below.

The kestrels nested in April and young fledged the third week of June. In a sample of three pairs the average number fledged was 4.0 (5-3). Female nestlings outnumbered males two to one. Deserted buildings were commonly utilized. Cavities were seldom found in the native juniper trees but were used when the holes were available.

Kestrels tolerate one another quite well. At two nests a second pair were in residence within 200 yards. Lone males were seen near other nests. Nonbreeding males were observed throughout the valley. They often occupied perches along roads, miles from suitable nesting sites. One male could be found in a group of trees 50 yards from one of the Grandine nests. It would vigorously protest human intrusion, but no female was ever seen in dozens of sightings.

Food habits were unknown except for a few kills witnessed on roadsides. One was a *Microtus*; the others were unidentified small mammals.

The single female known to have wintered in Curlew Valley was a partial albino. She was first sighted in early fall 1968 and was banded in December. Her eyes were a smoky gray; two light stripes of gray could be seen on her head. The upper secondary coverts were also pale gray, giving the appearance of two bands across her back. The tail had a faint red cast caused by light red pigment in the same position as the red bands on a normal female kestrel. The alternating black tail bands were completely lacking. Her feet and cere were bright yellow. Three of the central tail feathers were heavily worn and broken. The tail banding and size of the feet were used to determine the sex.

No further sightings of the albino were made until 23 March, when she was found less than a mile south of where she was banded



the December before. She was again seen in May, 2 miles north of the banding point, then the next day, one-half mile south of it. On these last sightings it could be seen that the damaged tail feathers had been replaced by the molt. The reddish cast to the tail was still evident, but the presence of wing coloration could not be determined.

This albino evidently did not breed. Nesting females could be found in close proximity to their nesting site. Even after the fledging of the young, family groups remained within three-quarters of a mile of their nest until mid-July. The albino's movement of 3.5 miles in 24 hours and her solitary condition did not fit the pattern of a breeder.

### HARRIER

#### *Circus cyaneus*

Like the short-eared owl, harriers were common nesters but difficult to locate. During every month of the winter, harriers were in Curlew Valley. On 12 February, five were seen diving at and chasing one another; this was the same day that similar behavior was observed in a group of short-eared owls.

A single nest was found. It had five eggs, three of which hatched. On 15 June, one young could fly and the other two hopped and ran through the surrounding cover. No prey remains were found because of the mobility of the young and because the parents removed leftover kills. Adults were, however, flushed twice from immature horned larks.

Fewer than a dozen adult (gray) males were heavily outnumbered in the valley by dark birds. Some of the dark birds were certainly subadult males and may have been breeding (see Hamerstrom, 1969:376).

### FERRUGINUS HAWK

#### *Buteo regalis*

Of all the tree-nesting raptors, ferruginous hawks most fully utilized the nonagricultural lands of Curlew Valley. Twelve pairs were found nesting. Eleven nests were successful, and one failed before the hatch. Forty-one young fledged, yielding a production of 3.4 per nest (5-1). Hatching day averaged 15 May with the mean fledging date of 5 July. All 12 pairs utilized existing nests. Eleven of these were in junipers and were not significantly altered. These 11 appeared to be old ferruginous hawk nests. The 12th nest was in a windbreak of eight narrow-leaved cottonwood trees between two plowed fields. Although an old nest was used, it appeared to be that of a Swainson's hawk (*Buteo swainsoni*). Indeed, a Swainson's hawk was flushed from this group of trees in late March. On 6 April, two ferruginous hawks were seen carrying sticks to the nest. Both birds participated. The material was gathered from beneath the windbreak in which the nest site was located. Both birds seemed to arrange sticks, but one made more gathering forays. The nest was

nearly doubled over its original size. A pair of Swainson's hawks was found nesting 400 yards from these ferruginous hawks.

Mortality was recorded at four nests. One nest was found late; it had a single three-week-old chick in it. The loss of eggs or nest mates is assumed. At the other three nests, some of the young died within three weeks of fledging. One became entangled in the nest tree when it left the nest in a storm and was strangled to death. Two out of five young died in a nest where the adult male was found dead three weeks earlier. There was no indication that he was replaced; from the first week of June until 2 July a lone parent kept five young alive, and by 9 July three of them fledged.

A fledged young in a fourth nest died while attempting to regurgitate a rabbit foot. No other food was in the crop, and the foot was not digested. This indicated that it had been swallowed not long before death.

Food habits of this species showed the greatest variety of any hawk recorded; 12 species of prey items were found. Eighteen pellets were examined; 10 of them were of rabbit fur, 2 contained weasel (*Mustela* sp.), 1 of *Thomomys*, 1 of *Dipodomys*, and 1 of short-eared owl. Three contained unidentified mammal. An indication of the variety of prey taken was noted from nest remains. Pheasant (*Phasianus colchicus*), meadowlark (*Sturnella neglecta*), leopard lizard (*Crotaphytus wislizeni*), and an adult male harrier were found along with the usual *Microtus*, *Citellus*, and both Lagomorphs.

Rabbits were an important part of the food brought to some nests but utilization varied. Using rabbit hind legs as an index to prey selection, the following variation was observed: three nests on a four-mile line in the Wildcat Hills showed 12 rabbits in 20 days, 7 rabbits in 30 days and 8 in 25 days. Two nests in Blackpine Valley had 6 rabbits in 30 days and 2 in 19 days. The frequency of rabbits, then, varied from 0.6 to 0.1 rabbits per day. The reasons for this inconsistent use of rabbits are unknown. Jack rabbits seemed abundant and cottontails could be found near rocks or heavy cover. It may reflect local rabbit fluctuations, or it may represent a selection being made by individual hawks. For the recorded nesting population, rabbits made up one-third to one-half of the diet.

In two instances adult ferruginous hawks were seen carrying large jack rabbits. Occasionally entire adult jack rabbits were found at the nest. All parts of rabbit skeletons were found often enough at the nest that it can be assumed ferruginous hawks are capable of regularly killing and carrying adult jack rabbits.

An interesting behavioral note was the presence of dry cow dung in the 11 juniper nests. Chunks of the dung were found in the top portion of the nest structure (see also Weston in Murphy, 1969:29). Cattle shaded under the nest tree and others nearby.

Ferruginous hawks have considerable tolerance for red-tailed hawks and for one another. In Blackpine Valley, which is a large, level expanse of sagebush and grass, four pairs nested. Two pairs of red-tails also nested there. Three ferruginous nests could be fitted on

a line 2.3 miles long. Less than a mile north of the line was a successful pair of red-tails. If lines were drawn from the red-tail nest to the end nests on the line, a triangle measuring 1.3 by 2.3 by 2.4 miles would be formed. On its perimeter were nests of three ferruginous hawks and a red-tailed hawk. Within its boundaries was a fourth ferruginous nest. These five nests represented 10 adults and 19 fledged young. A second successful red-tailed hawk nest was 1.7 miles west of the western corner of the triangle. All nests were in sight of one another.

#### RED-TAILED HAWK

##### *Buteo jamaicensis*

Seven nests of red-tailed hawks were located in Curlew Valley; five fledged young. Eight young are known to have fledged from four nests with one nest unaccounted for. Production was 2.0 young per nest. Average laying date was 12 April and average hatching date 15 May. The young fledged during the second week of July. Four young were found dead before fledging. Two were blown out of the tree, along with half of the nest material, at three weeks of age. The third disappeared at 20 days. The fourth chick found dead was a lone chick in a nest with a parent bird having subadult plumage.

Nesting red-tailed hawks generally preferred trees taller than junipers. Four were in cottonwoods, one in an aspen, and two in very tall junipers. This affinity for tall trees caused red-tails to nest in agricultural land 57% of the time. Agricultural land, it should be recalled, made up only 14% of the valley. The red-tail diet reflects this association also; out of 18 prey items found in pellets, 8 were *Microtus* and 7 were *Thomomys*. The others were a lizard and 2 rabbits. When these pellets were gathered adult red-tails were seen on fence posts in agricultural lands; later in the nesting season rabbits became common nest remains. The hawks may have had to shift their emphasis to rabbits due to the maturing crops that provided increased cover for small rodents.

Four red-tailed hawks in immature plumage were resident in Curlew; one nested with an adult mate. The nesting site was in a half-dead Lombardy popular on a creek bank. A dilapidated hawk's nest was present from years past. On 5 April the pair exhibited nest defense. Copulation was observed on 3 May (22 days after neighboring red-tails had begun laying). The immature plumaged bird took the inferior position, indicating that it was the female.

Eggs of an unknown number were in the nest on 24 May. By 7 June, young were being fed. The nest was climbed for the first time on 15 June; one chick and one egg were found. The chick hatched on or about 6 June, two weeks later than average. Green leaves, which are usually brought into nests periodically by red-tails, were not present. The entire structure looked little improved from its deteriorated state of the previous season. The young did not survive to the age of two weeks. No indication of the chick's fate was apparent, nor could the adults subsequently be found.

The pair was late in becoming established and were not vigorous nest defenders. Nest building or improving, along with the frequent "greening up" of a nest with leaves, may be for the purpose of strengthening the pair bond. These things were not done, which may indicate that this nest was a marginal attempt, and not likely to succeed. A second pair of red-tailed hawks with a member in immature plumage was found off the study area. Their eggs did not hatch.

The other three birds in immature plumage were seen separately throughout the valley in the same areas but with no regularity.

#### SWAINSON'S HAWK

##### *Buteo swainsoni*

Six nesting pairs of Swainson's hawks were recorded. Of all the raptor species studied, they were the latest to nest. On 2 May, a partial clutch was found. Hatching dates occurred in the first week of June. The six-nest fledging average was 2.0 per nest (4-1). A seventh pair defended a dozen junipers containing a number of old nests, but no active nest was found. Elsewhere, a single nest is known to have failed. On 8 June, the only egg in it was heavily pitted; two weeks later the nest was empty.

Swainson's hawks exhibited the only communal hunting seen in the valley. On 9 June, 4 Swainson's were following a plowing operation east of Cedar Hills. On 15 June, 12 Swainson's were circling or perched near a hay mowing operation west of Snowville, Utah. In both cases successful attempts to secure prey were witnessed.

Jack rabbits were found in two nests. *Thomomys* were also found. Brewer's blackbird (*Euphagus cyanocephalus*) and a lark sparrow (*Chandestes grammacus*) were recorded. In one visit, remains of three young jack rabbits and a meadow lark were in a nest.

#### TURKEY VULTURE

##### *Cathartes aura*

Vultures were first seen in April; thereafter, they were regularly seen in the Grandine area. They are cliff nesters, and east of Grandine a few outcroppings occur that might provide appropriate nest sites.

Late in June at Grandine, a single vulture was flushed from a dead rabbit on the road. Twenty minutes later, half the rabbit and the vulture were gone. No sightings of more than one or two vultures were made until 4 August, when seven were seen soaring north of Grandine. On 9 August, five were again seen north of Grandine.

#### ACCIPTERS

During the month of April all three Accipters (Cooper's hawk, sharp-shinned hawk, and goshawk) were seen in various parts of the

valley. No observations were recorded during May or June. The birds seen early in the summer were probably passing through to their nesting habitat in the nearby mountains where they are known to nest. On 12 July, a Cooper's hawk was seen at Grandine. It was being mobbed by resident kestrels. The hawk was probably representative of the dispersal of young and adults from nesting sites. The valley might possibly be utilized by the birds for postnesting activity.

#### INTERSPECIFIC BEHAVIOR

At Grandine a kestrel nest was located 30 yards from a red-tailed hawk's nest. When investigators were in the immediate vicinity of the nests, the red-tails usually took prominent perches in nearby trees. When the kestrel's nest was being climbed, the kestrels would circle and "kack" at the intrusion. Without fail, they would begin diving at the perched red-tails, manifesting redirection behavior (see also Moynihan, 1955).

This same redirected behavior was noted once with prairie falcons and golden eagles. The two species nested about 2 miles apart. The falcons were vigorous nest defenders, diving and circling continually when disturbed. The eagles, on the other hand, quietly slipped away when flushed. After drawing a strong response from the falcons, the eagle eyrie was then visited. As the adult left the nest and was gaining altitude, a prairie falcon began diving at the eagle. The eagle showed little response, but climbed higher, drawing its antagonist with it. The falcon finally broke off the attack and drifted toward its own nest.

Kestrels mobbed a Cooper's hawk at Grandine late in the summer; it is believed that the accipiter was not resident but merely moving through. Since hawks with bordering or overlapping territories usually did not bother one another, the prairie falcon mentioned above only reacted under extraordinary conditions.

While two ferruginous hawks were protesting a visit to their nest by the investigator, two Swainson's hawks appeared and began circling and screaming also. The Swainson's were those described earlier as defending a stand of junipers with no active nest.

#### CONCLUSIONS

Forty-five nests were found; nine of these failed. Of the nine, five failed before hatching. Since nest locating was easier after the adults began carrying food to nests, it is probable that some failing nests were not located. Twenty per cent failure (9 of 45) should then be considered a minimum.

No raptor was found to have an obvious limiting effect upon its prey species. The examples of narrow prey selection were eagles on rabbits and the prairie falcon's predation on avocets; both prey items were abundant. All other nests exhibited diversity in prey selection which followed the suspected relative abundance of prey items.



The habitat evidently had pronounced effects on nesting raptors. An overview of the map plotting nest locations shows a clumping of nesting birds. Cliffs or outcroppings suitable for raptors were not common. Every cliff in the valley which seemed suitable to the observer had either an eagle or prairie falcon nesting on it. Non-nesting, subadult golden eagles were present in the valley. Due to the scarcity of nesting sites, they did not have to compete with nesting adults.

Ferruginous hawks frequently nest on the ground (Weston, *in* Murphy *et al.*, 1969; Williams and Matteson, 1948). There they build a large stick nest comparable to the structure they place in trees. These hawks have two avenues open to them in their utilization of Curlew Valley: by nesting both on the ground and in the trees, they could evenly distribute themselves throughout the uniform sagebrush and shadscale habitat. This would reduce intraspecific competition and make for more effective use of the prey populations. Or the hawks could restrict themselves to tree nesting sites. Since the juniper trees are clustered, the hawks would also have clustered distribution. Prey populations farther from trees would thereby conceivably receive less attention from nesting birds. Tree nesting would also intensify interspecific competition for both nesting sites and food resources among ferruginous, red-tailed, and Swainson's hawks.

The apparent advantages of dispersion through ground nesting are outweighed by the security of tree nesting, as no ground nests were found nor was any evidence found that they had ever been employed. Besides the 11 active ferruginous juniper nests, between 20 and 30 inactive or alternate tree nests were located throughout the valley.

Red-tailed hawks generally limited themselves to trees other than juniper. The two juniper trees used for nest sites were taller than usual, as was mentioned earlier. One of the pairs used a nest that had been built in an earlier season. It seemed too shallow for ferruginous hawks and may have been built originally by red-tails. The second nest, however, was built that spring and was a mere jumble of sticks by the time the young fledged. One of the two young disappeared during their fourth week. More young may have been lost earlier, as they were 20 days old when found.

Krestrel nesting sites were commonly associated with human alterations. Buildings and exotic trees around farms provided the bulk of nesting habitat for these falcons.

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